IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

ATTY.'S DOCKET: MATSUI=5

In re Application of:	Art Unit: 1756
MATSUI et al.	Examiner: Martin J Angebranndt
Serial No.: 09/928,833	Washington, D.C.
Filed: August 14, 2001	January 12, 2006
For: OPTICAL RECORDING MEDIA	

DECLARATION UNDER 37 CFR 1.132

Honorable Commissioner for Patents
U.S. Patent and Trademark Office
Customer Service Window
Randolph Building, Mail Stop
401 Dulany Street
Alexandria, VA 22314

Sir:

1. I am one of the coinventors in the captioned application.

2. I am a citizen of Japan residing at 2-18-102, Sayamadai 2-chome, 1-ban, Sayama-shi, Saitama 350-1304, Japan.

3. An accurate copy of my Curriculum Vitae was attached to the Declaration of June 8, 2005 which was filed to the United States Patent and Trademark Office on June 20, 2005.

4. Here I further state my opinion of JP60-204396 which has been cited as a prior art by the Examiner in the Official Action of August 22, 2005.

5. In my previous Declaration, I stated as follows:

The optical recording medium according to this invention is based on a recording strategy where in an optical medium using a violet or blue laser to effect recording and reading out of data, the laser is absorbed by a thin membrane of organic dye in the optical recording medium at a shorter wavelength region against the absorption maximum of the organic dye.

6. I carefully reviewed the whole content of JP60-204396 and concluded that the optical recording medium of this invention is still entirely novel against JP60-204396 and unobvious therefrom because JP60-204396 neither discloses nor suggests anything about

our recording strategy.

7. According to my knowledge and experience, JP60-204396 discloses at most a recording strategy which is feasible solely in optical recording media using a certain laser, for example, semiconductor laser, which gives an oscillation line around 750, 780 or 830 nm. JP60-204396 teaches in fact that data can be wrote in and read out from such an optical recording medium with the use of a laser whose wavelength lies within the range of 40 nm shorter to 70 nm longer than the absorption maximum wavelength of an organic dye. This recording strategy was however defined and tested only for semiconductor lasers with oscillation lines around 750, 780 or 830 nm (see line 8, right lower corner, page 15 to light upper corner, page 16 in JP60-203496). JP60-204396 is entirely silent on violet or blue laser per se, as well as disclosing or teaching nothing about the feasibility of such a recording strategy in optical recording media using violet or blue laser as light source. The reason must be that as well known in the art, violet or blue laser was at last brought into practical use in 1999, therefore unavailable at the time when JP60-204396 was filed.

8. JP60-204396 taught in fact that several lasers of He or Ar type, such as He-Ne, Ar and He-Cd lasers, could be used as light source in optical recording media. In the last Official Action, the Examiner stated that violet or blue laser may substitute for these lasers. According to my knowledge and experience, violet or blue laser never substitute for any lasers in JP60-204396 because of differences in oscillation wavelength and power. Each of He-Ne, Ar and He-Cd lasers give several distinct oscillation lines: For example, as well known in the art, Ar laser gives at least two oscillation lines around 488 and 515 nm. Each oscillation line however lies very far from violet or blue laser (usually around 400 nm), as well as from 750, 780 and 830 nm which were practically used in JP60-204396 to define and test its recording strategy.

9. As to optical recording media using a laser of Ar or He type, Kenryo Nanba, one of the coinventors in JP60-204396, later reported in "*Shikizai-Kogaku Handbook*" (Handbook of Colour Material Technology", page 1,272, edited by Japan Society of Colour Material, published by Asakura Shoten Publisher (1997) that in an earlier development stage of optical recording media, several distinct lasers of Ar or He type were in fact tried to

use as light source, as well as that such a trial was however proved to be unsuccessful because at that time, there were available no organic dyes which might give a sufficient reflection rate in optical recording media. As well known in the art, He-Cd laser gives much shorter oscillation lines (325 and 442 nm). If as reported by Nanba, organic dyes in an earlier development stage of optical recording media are less sensitive to Ar laser, then other shorter lasers such as those of He type would be much less practical in optical recording media.

10. Because of these facts, I do state again that according to the disclosure of JP60-204396, its recording strategy would be feasible only in optical recording media using a certain laser which gives an oscillation line around 750, 780 or 830 nm (for example, as in the case of CD-R), but unpractical in optical recording media where violet or blue laser, oscillation wavelength at around 400 nm, is used to write in or read out from optical recording media such as Blu-ray Disc and HD DVD-R.

11. I hereby further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon:

Fumio Matsui

Fumio MATSUI

12^{th} day of January, 2006

Date

Excerpt Translation of "*Shikizai-Kogaku Handbook*" (Handbook of Colour Material Technology), edited by Japan Society of Colour Material, published by Asakura Shoten Publisher, 1997

色材工学
ハンドブック

(社)色 材 協 会
編 集

朝 倉 書 店

6. 光記録材料

6.1 光記録材料の概要

今日の社会に氾濫する大量の情報を記憶しうるメモリーとして磁気記録媒体が使用されているが，より高密度，大容量化が必要となってきた．この要求を満たすために，追記型 (direct read after write; DRAW) または WO (write once)，WORM (write once read many) などと呼ばれる，ユーザーが記録再生可能な光メモリーディスクが 1981 年から市販されている[1]．当初は Te を主成分とする記録膜がほとんどであり，シアニン色素を用いた光メモリーディスクが 1985 年に実用化[2]されるにいたって，色素系記録膜の研究，開発が活発に進められている．このほか色素材料にはフォトクロミズムを示す物質などによるフォトンモード記録があり，消去，再記録可能な光メモリーの開発が期待されている（本編の 7.2 参照）．また，光の干渉を利用した記録方法としてホログラフィーがあるが，ここではヒートモード記録である追記型光記録用色素材料について述べる．

ヒートモード記録とは吸収した光エネルギーが熱エネルギーとなり，多くの Te 膜や色素膜が昇華，融解または分解して記録最小単位としてのピット（小孔）を形成する方法である．したがって，ピット形成時に物質移動をともなうため，ディスクは図 6.1 のようなエアーサンドイッチ構造をとり，膜面を自由とする必要がある．また，基板側からの反射率変化を信号として検出する記録再生方式がドライブに採用されていることから，記録膜には一定以上の反射率が要求される．開発の初期においては Ar や He–Ne レーザーなどの発振波長に吸収をもつ，反射率の低い色素が用いられていたために，金属反射膜を設けることが必要であり，実用にはなっていない[3]．

半導体レーザーの発振波長（近赤外）に吸収を示す色素の探索が進められ，バナジルフタロシアニンの単層膜が吸収と同時に高い反射率を示すことが報告された[4]が，低感度であり，また蒸着膜であったことから，色素材料を用いた光メモリーディスクの特徴が生かされなかった．

色素系追記型光メモリーディスクの主な特徴は，長所として長寿命，低毒性，製膜工程の低コスト化（スピンコート法），高感度，などがあげられる．短所としては，低反射率，記録閾値が不明確，再生光に対してヒートモードの劣化，また再生光および環境光に対してフォトンモードの劣化などを起こす場合がある[5,6]．ただし，環境光に対しては，ディスクがケース入りとなった[7]ためにほとんど問題ないとされている．

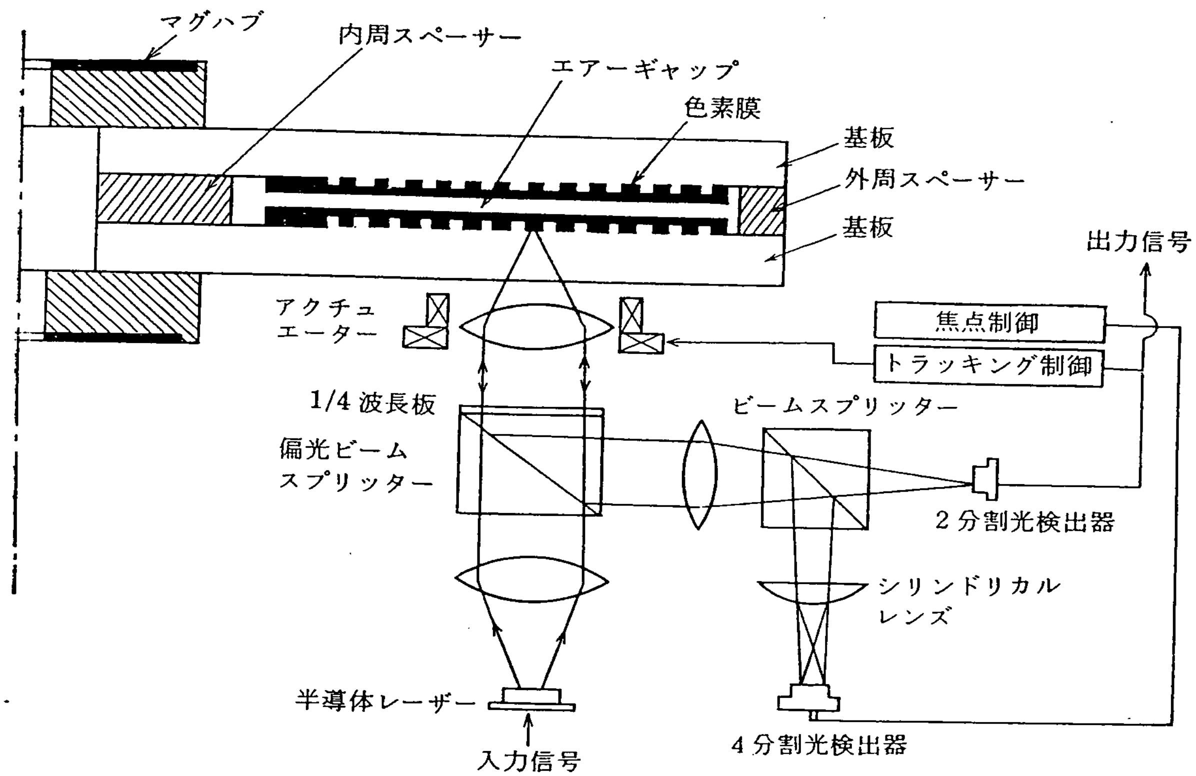

図 6.1 有機色素系光ディスクの基本構成
エアーサンドイッチ構造はピット形成型の追記型光ディスクに共通のもの.
光学ヘッドからの光は基板を通して記録再生を行う.

6.2 光メモリーディスク用色素に要求される特性

色素を用いた光メモリーディスクの長所および特に短所を考慮すれば，光メモリーディスク用色素に必要とされる特性は，以下のようになる[6].

（1） 薄膜化できること．特に，スピンコート法で製膜するためには適当な溶剤に可溶であること．溶剤は適度な比蒸発速度をもち，ポリカーボネート基板を侵さないマイルドなものが望ましい.

（2） 薄膜は均一であって，結晶化など粒子性を示さないこと.

（3） 薄膜は記録再生用レーザーの発振波長において，十分な吸収をもつこと.

（4） 吸収と同時に，同一波長において適度な反射率をもっていること.

（5） 吸収および反射の波長依存性はなるべく小さく，レーザー発振波長付近でなるべくブロードであること.

（6） 融点，熱分解点，昇華点などが適当な温度であり，なるべく急激に変化すること.

（7） 熱，光，湿気その他のガスに対して安定であること.

（8） 毒性のないこと.

最近，以上の要求特性を備えた光メモリー用色素の提案が急増しているが，多くは古くから知られている色素骨格を分子設計し直したもの，または電子写真用感光体として開発され

色材工学ハンドブック

定価は外箱に表示.

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Excerpt Translation of "*Shikizai-Kogaku Handbook*" (Handbook of Colour Material Technology), edited by Japan Society of Colour Material, published by Asakura Shoten Publisher, 1997

Translation of page 1,272, 2nd paragraph

"Heat mode recording system is a method where pits (small pores), as minimum recording units, are formed in such a manner of converting absorbed light energy into heat energy and then subliming, melting or decomposing most of the Te (tellurium) membranes or dyes used in organic dye optical recording media. Therefore, heat mode recording system accompanies the transfer of substances when pits are formed, and discs for organic dye optical recording media should have the air-sandwich structure as shown in FIG. 6.1 and the surface of the discs should be made to allow the substances to move freely. The organic dye optical recording media employ in a drive unit a recording and reading out system for detecting as signals a reflection change in substrates so that recording membranes are required to have a prescribed level of reflectance. In the beginning of exploitation, no organic dye optical recording medium was succeeded in actual use because such optical recording medium inevitably required a metallic reflection membrane due to the use of dyes which had a relatively low reflectance and an absorption at the oscillation wavelength of Argon or HeNe laser."

Translation of page 1,273, FIG. 6.1

6. Optical recording material

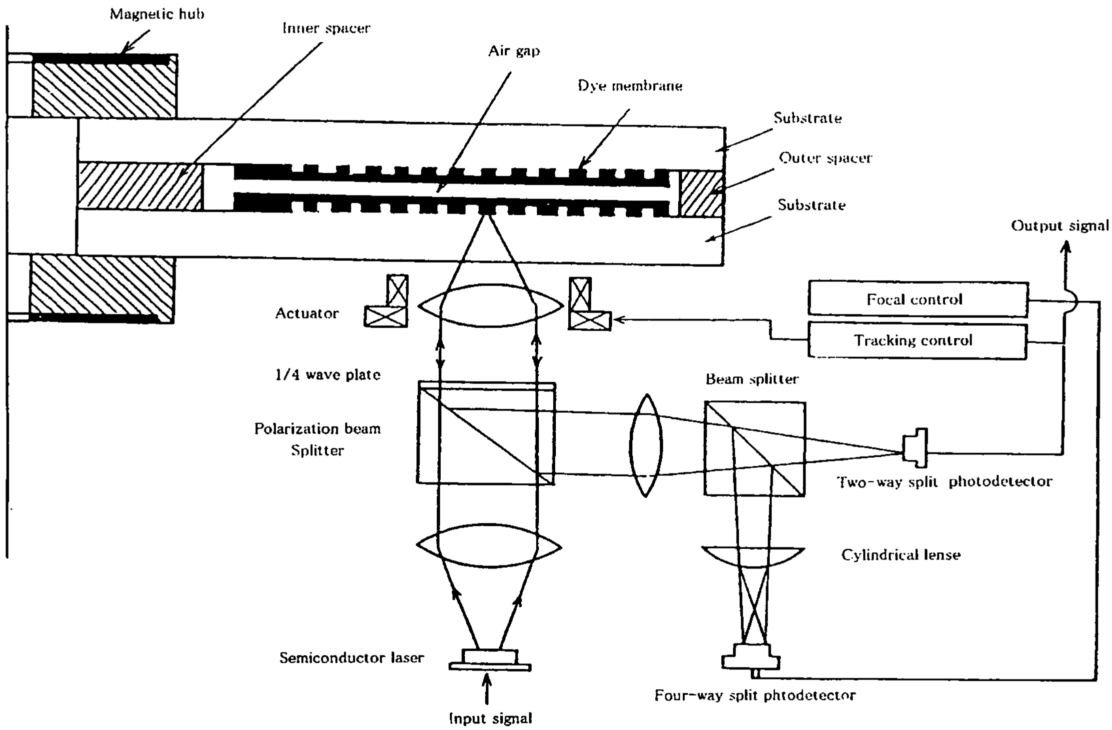

FIG. 6.1 Basic structure of organic dye optical disc
Air-sandwitch structure is a common structure in write-once optical disc in a pit-formation type.
Light passing through optical head records/writes information.

MAGNETO-OPTICAL RECORDING MATERIALS

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CONTENTS

Chapter 1

INTRODUCTION

Takao Suzuki

1.1 INTRODUCTION

Today, electronic information is pervasive: text, digital audio and video, graphics, telecommunication and so on, and various information-storage technologies have been developed in the past decade. Among them, optical storage is rather a newcomer, though its unique features and advantages in the storage industry have been known for a long time. With significant developments in the laser and semiconductor industries, optical storage technology has already successfully emerged into the consumer market and more recently into the computer-based data storage market as well.

The 120 mm, prerecorded compact disc (CD), having the standard format specified in the Red Book[1] and the rewritable 5¼″ and 3.5″ size magneto-optical (M-O) technologies are noteworthy. While it took more than seven years for the CD market to take off, it is now a very prosperous industry, with over 500 million disks produced in 1996 vs. 200 million in 1993. For computer-based data storage and multifunctional purposes, the first generation of the ISO[2] standard 5¼″ M-O drive (325 MB × 2/double-sided) was introduced in 1988 and the 3.5″ drive (128 MB) in 1991. Since then, progress has been remarkable in capacity and data transfer rate as well as cost performance, and the so-called 2X (650 MB × 2/5¼″ double-sided disk) and 3X (1 GB × 2/5¼″ double-sided disk) drives are now in the market. Also, a remarkable product called the MiniDisc (2.5″), which was the first recordable optical system for both the consumer and the data market, has made a breakthrough in the technology utilizing data compression and direct overwrite schemes. Furthermore, archival storage has become, for legal reasons, a more necessary requirement of various financial, medical, and telecommunication industries as well as government agencies, where terabytes of storage (10^{12} bytes) are not atypical. In this application area, various types of write-once/read-many (WORM) optical libraries have been developed, where their permanent form of storage is being well accepted in the marketplace.

Many types of optical storage media have been intensively studied for various applications. Figure 1.1 illustrates some examples. Except for the magneto-optical recording medium, the optical contrast (signal) results from the reflectivity difference between the written and unwritten marks. For magneto-optical recording media, a

[1]The physical standards for CD Audio were originally published in a red binder and have become known as the Red Book. Subsequent standards have been called the Yellow Book for CD-Read-only Memory (CD-ROM), the Green Book, Orange Book, etc. (see Table 1.1, and also Chapt. 11).

[2]ISO stands for International Standards Organization. The file format for the CD-ROM is defined in Standard ISO 9660.

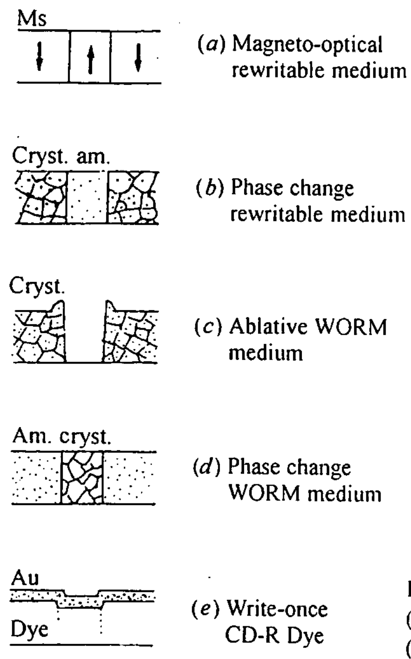

Figure 1.1 Various types of optical media: (*a*) and (*b*) are rewritable media, (*c*) through (*e*) are the writable media.

change in polarization direction due to the magnetization direction is the source of the contrast.

Key features of optical storage technology are removability and high capacity on a disk. The removability is important because it allows access to multifunctional applications with compatibility from drive to drive. It also allows us to transport huge amounts of information by hand. For example, one can carry the information equivalent to a 40,000-page document (2 ft high) in an optical 5¼″ disk. Capacity is important because it translates to low cost/MB and to space-efficient storage. The latter is important especially for places such as Japan where land/office prices are anomalously high. Consider, for instance, an insurance company that desperately needs to rid itself of paper claim forms—but needs access to customers' records instantly. Scanning these original documents and storing them on magnetic hard disk drives would be too costly, while tape systems would not have enough speed to randomly retrieve hundreds of thousands of images in a timely manner. Optical storage provides the best solution for this dilemma. Figure 1.2 shows the progress of optical disk storage technology under 12″ size. The increase in capacity is more than 50% per year in the past six years.

While optical storage is an attractive storage technology, magnetic hard disk recording is the dominant technology for information storage. Its growth rate in density has been almost 30% per year for the past 40 years. In the past couple of years, the increase is close to 60% and is expected to continue on the increased capacity rate well into the foreseeable future. Driven by such an ongoing increase in storage densities of magnetic recording, and confronted by upcoming multimedia applications which demand more user data capacity, substantial efforts have been focused on the improvement of storage density (and data transfer rate) in optical storage systems as well.

By no means is the solution for increasing the capacity simple since such an increase must be decided by such factors as backward compatibility. This feature is important to removable media because the customer expects new products to be com-

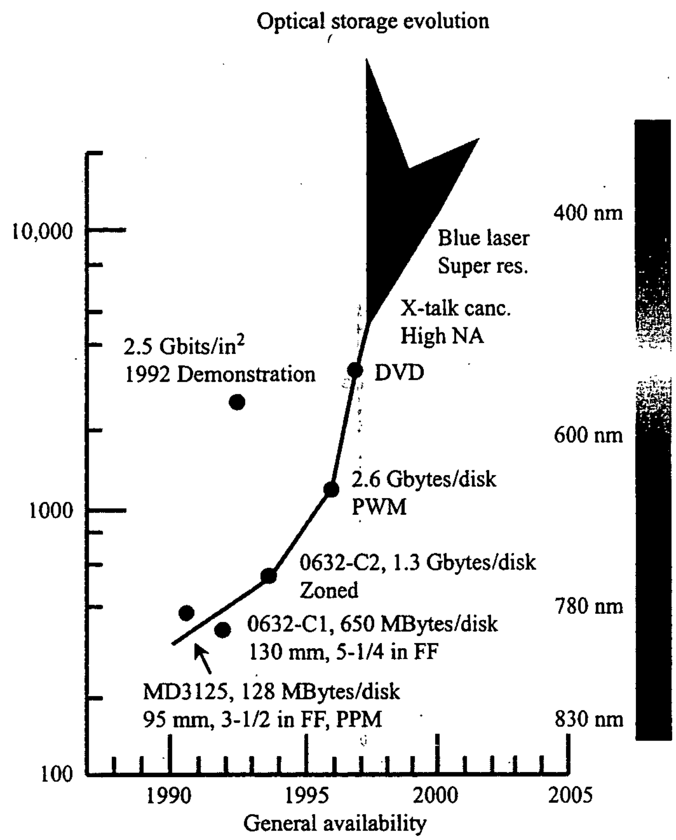

Figure 1.2 Evolution of optical storage technology. The acronyms are explained in the text.

patible with their previous investments in data stored on older generation media. Another key factor is cost. The sale price ($/MB) must be significantly lower compared to other prior generations of optical storage products and alternative storage systems (e.g., removable hard disk drives).

To increase the capacity in optical storage media, many solutions are possible:

Shorter wavelengths [1],

$$1.5(670\,\text{nm}) \sim 3.8\text{X}(428\,\text{nm})$$

Magnetically induced super resolution (MSR) [2, 3]
(see Chapter 9)

$$\geq 2\text{X}$$

Pulse width modulation (PWM)

$$1.5 \sim 2\text{X}$$